The Effects of High-Interest Rates on Depositor Behavior

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Executive Summary

The U.S Banking sector observes substantial changes in depositor behavior during periods of increases in interest rates. We compiled multidimensional panel data of over one million banks' deposit compositions that were measured quarterly from December 1992 to June 2022 and obtained from the call report data from the Federal Financial Institutions Examination Council (FFIEC). A panel regression model was used to estimate the changes in aggregate deposit level and deposit composition by controlling bank-level idiosyncratic properties as fixed effects.

The quarterly effective federal funds rate was utilized as the proxy of the prevailing interest rate in the financial market. All deposits were measured in real terms by dividing the nominal terms by the contemporary national Consumer Price Index (CPI). Various bank properties were also included as control variables, including bank classification, ownership type, asset specialization, location, trust powers granted, and the number of branches accepting FDIC insurance. Since the transmission of monetary policies is usually considered to have lingering lags, historical four-quarter policy rates were also included as control variables to estimate the delayed effects of historical interest rates. Finally, a separate model was developed to analyze the adjustment in deposits for an increase in the change in interest rates, quantifying the deposit channel under interest rate shocks. Tables 1 to 6 are the summary reports of regression results, and Tables 7 and 8 are the definitions of all variables included in the panel regression model.

The regression result predicts that aggregate deposits decrease at an increasing rate when the policy rate rises until it reaches 8.54 percentage points. When the policy rate rises, domestic deposits grow at an increasing rate. In contrast, foreign deposits continue to grow at a decreasing rate and then start declining until the interest rate reaches a certain level. For the changes in bank deposit compositions, our regression estimates detect deposit outflows from non-interest bearing to interest-bearing deposits and from non-time deposits, such as demand deposits, to time deposits. Brokered deposit proportions are decreasing at an increasing rate, and insured deposit proportions tend to decrease and then increase as the policy rate escalates.

We have made policy recommendations after recognizing the instability of banks' funding sources caused by large deposit outflows and the rise in banks' funding costs due to the change in deposit compositions under the high-interest rate environment. Refinements of banks' liquidity risk management systems could prevent the potential systematic instability in the banking industry. Modifications towards the restrictions of the brokered deposit were also recommended to maximize banks' access to this enormous funding source and minimize its volatility. Regulators could also expand banks' depositor base by lowering insurance thresholds, improving depository service quality, and devoting more investment to developing mobile software, enhancing public awareness of banks' liquidity risk.

Introduction and Literature Review

An empirical study by Drechsler, Savov, and Schnabl (2017) proposed a deposit channel of monetary policy to examine the effect of change in federal funds rate on the aggregate deposit level. They hypothesized that agents in the economy hold three assets: cash offering zero interest rates, saving deposits offering low-interest rates, and bonds offering interest rate equivalent to the federal funds rate. Bond yields tend to adjust simultaneously with the policy rate, while deposit rates barely change and remain relatively low even in a high-interest rate environment. Therefore, when the federal funds rate increases, the spread between bond yields and deposit rate widens, which signifies higher opportunity costs of holding deposits or cash. Such deposits outflow from the banking system to the financial market is described as the deposit channel of monetary policy.

Moreover, economist Rafael Repullo (2020) critiques the model proposed by Drechsler et al., proposing that interest rates have ambiguous effects on deposits level. He demonstrated a U-shaped relationship between deposits and interest rates, where deposits first decrease but then increase as interest rates rise. In his model, the effect of an increase in the policy rate on equilibrium deposits can be decomposed into a negative substitution effect due to an increase in the opportunity cost of holding deposits and a positive income effect due to a higher return to the household's financial wealth. When the policy rate is near zero, cash and deposits yield the same return as bonds. Due to the liquidity services banks provide, households tend to invest most of their wealth in cash or deposits and decrease that investment when the policy rate rises due to the negative substitution effect. As the interest rate reaches a certain high level, the income effect increases the aggregate deposit level.

Aside from deposits outflow from the banking system, the bank's internal deposit composition should also change in response to interest rate hikes. Generally, the proportion of demand deposits equivalent to cash tends to decrease. Research by Michael Choi and Guillaume Rocheteau (2021) shows that these depositors tend to have low liquidity needs, enabling them to replace their demand deposits with bonds. The research by Gerlach et al. (2017) showed that hikes in the federal funds rate generate deposit outflow from non-time deposits to time deposits.

Deposits compose around 75% of bank balance sheets (Gerlach et al., 2017). The stability of deposit inflow allows banks to expand illiquid assets, particularly small business loans, so decreases in deposits induce the reduction in lending services and exacerbate the tightening effect of monetary policies (Gerlach et al., 2017). To recover the loss in demand deposits, banks have to offer higher payment on interest-bearing deposits, which also increases banks funding costs. High-interest rates also cause depreciation in the present value of banks' assets along with a deposit outflow, which further intensifies bank insolvency risks. The deposit channel of monetary policy could have a profound impact and contribute to the systematic instability of the banking industry.

Our paper is structured in the following format. First, we showed the existence of aggregate deposit outflow as interest rate increases. Second, we discussed the changes in banks' deposit compositions and showed increased risk of insolvency with higher interest rates. Our concluding section contains broader implications for the banking system and what policies that regulators can use to mitigate the bank liquidity and insolvency risk.

Total Deposit

The model used to predict the natural log of total deposit level is significant with F(26, 989566) and 1,006,135 observations, according to Table1. A significant quadratic interest rate term is also obtained, which verifies the U-shaped relationship between total deposits and interest rates. As interest rate increases, total deposits decrease at an accelerated rate until interest rates reach 8.67 percentage point. That quadratic relationship is significant at the foreign deposit level but not at the domestic one. Holding all else constant, domestic deposits rise at an increasing rate when the policy rate increases. By contrast, foreign deposits keep increasing at a decreasing rate until the interest rate hits 5.50 percent, which is probably brought by the capital inflow following interest rate hikes.

The delayed effects of interest rate on deposit level are also significant. When the interest rate from nine months ago increases by one percentage point, the total deposit level increases by 8.11 percent on average. For the effect of an interest rate shock, the total deposit level is predicted to decrease by 2.00 percent by a percentage-point acceleration in the change in interest rates.

In conclusion, empirical evidence demonstrates that a high-interest rate environment could drive a deposit outflow from a depository institution to other financial sectors with higher yields, exacerbating fundraising uncertainty and liquidity risk in the banking center.

The Deposit Composition

The response variable in this section is the ratio between the specific type of deposit we are interested in and the total deposits. Changes in deposit proportions are treated as a proxy for changes in deposit compositions and depositor behaviors.

Demand Deposits and Money Market Deposits:

Models estimating demand and money market deposits are also significant, with large F statistics and more than 940,000 observations, according to Table1. While demand deposits display a similar U-shaped relationship as the total deposits, money market deposits have an inverse relationship with interest rates. On average, elevated interest rates continue to cause deposits to outflow from the money market at an increasing rate. Even though money market accounts offer interest rates that tend to adjust in tandem with the policy rate, their returns are still significantly lower than bonds and other financial assets in a high-interest-rate environment. Such deposit outflow is triggered by the increased opportunity costs of holding money market deposits or demand deposits in a high interest-rate environment.

The U-shaped curve of demand deposits arrived at its turning point at 4 percent of interest rates. Demand deposits rise after interest rates reach 4 percent is probably because of the rising money transaction demand during the high inflation period when tight monetary policies are utilized to combat inflation. When high inflation exists, the liquidity service demand deposit provides is likely to outweigh the opportunity cost of holding it.

Saving Deposits and Time Deposits:

Saving deposits (excluding money market accounts) have a distinct quadratic relationship with interest rate compared with time deposits, according to Table2. Due to the low and slowly adjusted interest rate offered by saving accounts, saving deposit proportions start decreasing at an increasing rate when the interest rate hits 0.5 percent. It is estimated that a mild rate hike is sufficient to drive a saving deposit outflow. On the other hand, time deposit proportions increase at an accelerating rate when the policy rate surges. This phenomenon is observed since time deposits like bonds require depositors to lock their money for a longer time; the term risk attached to them should be compensated, and the history shows the interest rates offered by the certificate of deposits (CDs), an example of time deposits, tend to adjust synchronously with federal funds rate.

In a high interest-rate environment, the regression results imply that deposits continuously flood from demand and saving deposits to high-yielding time deposits. On the one hand, this phenomenon benefits banks since deposits, their staple source of funds, will become more stable and remain locked in their vaults for a longer period. Nevertheless, all this comes at a price. To recover the source of funds lost in demand deposits, banks need to offer higher interest rates for time deposits to seduce depositors from locking up their funds in higher-yielding bond investments, resulting in higher funding costs.

Interest Bearing Deposits vs. Non-Interest-Bearing Deposits

Interest-bearing and non-interest-bearing deposits are estimated by significant regression models according to Table2. Holding all else constant, as the current policy rate increases, the interest-bearing deposit proportion increases rapidly until the policy rate reaches 7.50 percent. The sharp declines in saving and money market deposits are probably why interest-bearing deposits start decreasing when policy hits surge. In contrast, the non-interest-bearing deposit proportion first decreases and then increases, with the same turning point as the interest-bearing one. Both deposits are affected by interest rates one year ago. When interest rates from the previous year increase by one percentage point, the interest-bearing deposit proportion increases by 1.60 percentage points. In contrast, the non-interest-bearing deposit proportion decreases by 1.60 percentage points at every current interest level. Therefore, regression results satisfy the hypothesis of deposit outflows from non-interest-bearing to interest-bearing deposits, raising banks funding costs.

Retail Deposits vs. Brokered Deposits

Under the FDIA and the FDIC's regulations, a brokered deposit is "any deposit that is obtained, directly or indirectly, from or through the mediation or assistance of a deposit broker." Brokered deposits are often offered by banks in large denominations to deposit brokers, who subsequently sell them to their consumers in smaller amounts. Retail deposits are the opposite of brokered deposits.

Both retail and brokered deposits are estimated by significant regression models according to Table3. Holding all else constant, the retail deposit proportion decreases as the current interest rate increases until policy rates reach 2.50 percent. When interest rates from the previous year increase

by one percentage point, retail deposits decrease by 1.50 percentage points at every current interest level. In contrast, the quadratic current interest rate is insignificant when estimating brokered deposits. Generally, when the current interest rate increase, brokered deposit proportion decreases at an increasing rate. Holding all else constant, a one-percentage shock in changes in interest rate tends to decrease brokered deposit proportions by 0.20 percentage points.

The reduction in brokered deposits is conjectured to be caused by interest rate caps and other kinds of restrictions imposed by the FDIC since 1989. (Federal Register, 2019, Vol. 84, No. 25) As a result, well-informed brokers direct funds raised from customers to investment opportunities with higher yields that brokered deposits are not commensurate with when interest rate increases. Fluctuations in brokered deposits are concerning because they have been widely considered a dangerous but important source of funds. On the one hand, tremendous brokered deposit inflows could reduce a bank's liquidity and insolvency risks. On the other hand, regulators are concerned about banks' usage of that source of funds: whether banks, especially not-well-capitalized banks, would use brokered deposits to fund additional risky assets. (Federal Register, 2019, Vol. 84, No. 25). Finally, regulators are also anxious about the volatility of broker deposits because brokers (on behalf of consumers) were often lured to high rates and inclined to withdraw deposits from the bank when they discovered a better rate in a high-interest rate environment.

Estimated Insured Deposits and Fully Insured Brokered Deposits

A significant regression model predicts the estimated insured deposit according to Table3. Holding all else constant, as the current interest increases, the estimated insured deposit proportion first decreases and then increases, and the turning point is at 1.17 percent of interest rates. When interest rates from the previous three quarters increase by one percentage point, estimated insured deposits decrease by 1.80 percentage points at every current interest level.

The proportion of fully insured brokered deposits is also estimated by a significant regression according to Table3. When the current interest rate increases, fully insured brokered deposits will decrease at an increasing rate, and interest rates from previous periods do not significantly affect predicting deposits here. The rapid decrease in fully insured brokered deposits in a high-interest rate environment is consistent with the analysis of brokered deposits.

On the one hand, less fully insured brokered deposits signify a diminished bank risk profile, and more insurance costs are applied to protect ordinary consumers instead of "mercenary" brokers. However, many banks still rely on brokered deposits generating a tremendous funding source, and brokers indeed have more bargaining power in this transaction. They can bid for the institutions offering the highest interest rate. Brokered deposit fluctuations against interest rates shown by the regression results may imply concerning volatility of this major source of funds. Besides, J. R. Barth et al. (2020) proposed that the use of brokered deposits may raise the expense to the FDIC of dissolving a struggling institution since the institution will have had access to more insured brokered deposits than it otherwise would have.

Conclusion and Policy Recommendation

In general, the liquidity risk associated with bank deposit outflows in a high-interest-rate environment is generated by the rising opportunity cost of holding deposits. For the bank's internal deposit composition, the proportions of non-interest-bearing deposits, such as demand deposits, tend to shrink. In contrast, the proportion of interest-bearing deposits, such as time deposits, will be inflated as interest rates keep increasing. When consumers continue withdrawing their demand deposits, banks are forced to raise the interest rate they pay on time or brokered deposits to sustain the source of funds. As increasing proportions of deposits held are interest-bearing, banks' funding cost is likely to increase along with the exacerbating liquidity risk. Economists have estimated the funding costs corresponding with such deposit outflows. (J. R. Gerlach et al.,2017) According to their research, the estimated consequence of a 100 basis points shock in interest rate is an approximately $39.5 billion rise in total deposit funding costs, given the cumulative replacement of lost deposit financing with expensive non-deposit funding and the adjustment in the deposit composition toward costlier deposits.

To mitigate the liquidity risk, regulators could assist banks in refining their liquidity and risk management system, fulfilling the seasonal financing needs and covering both anticipated and unanticipated variances from regular business operations. Depository institutions should formulate statutory regulations to enhance accountability among the hierarchical management teams. A statutory requirement should ensure managers actively regulate the bank's risk profile and properly understand the detrimental consequences associated with liquidity risk. For a clear separation of authority and responsibility, a bank should simplify the management structure of its risk control department by having only one chairman and integrating the heads of lending and savings services into the management team; the lending department is responsible for monitoring the bank's risk-taking, while the savings department is responsible for securing a stable source of liquidity.

Depository institutions should develop a more diversified balance sheet, balancing between various sources of funds ranging from demand and retail deposits to time and brokered deposits. They should also maintain a healthy proportion of easily collateralized and tradeable assets as a liquidity buffer; a total liquidity buffer accounting for more than 25 percent of total assets is suggested. Those institutions equipped with securities investment portfolios are recommended to construct portfolios that maintain sustainable cash flow under various monetary policy scenarios, especially rate hikes; it is recommended that over 20 percent of the portfolio should be composed of assets hedging interest rate hikes. A more efficient alarming or stress test system should also be implemented to ensure that liquidity risks are detected timely, and that risk alerts can be transmitted swiftly between banks and regulators to avoid any potential systematic collapse of the entire banking system.

Regulations of brokered deposits should be prudently structured. Brokered deposits are volatile but still serve as an important alternative funding resource to demand deposits during a higher interest rate environment. Therefore, we proposed that interest rate caps on brokered deposits should be more flexible, allowing banks to raise interest rates and compete with high-yielding financial markets for this essential funding source. As illustrated by our regression results, a strict interest rate cap may have contributed to the deposit outflow under a rising rate environment. However, restrictions other than interest rate caps should be implemented to ensure a healthy proportion of brokered deposits being held in banks, limiting the variance of their funding source.

The FDIC has already elevated the national rate cap considering a weighted average of all the prevailing interest rates among insured depository institutions and credit unions in December 2020. Our regression results suggest that brokered deposits are highly volatile during periods with federal funds rate and market interest rate adjustments. As a result, we proposed that the national rate cap of brokered deposits could be modeled after the cap on time deposits by referring to other U.S. treasury yields or money market instruments with similar maturities, incorporating more market dynamics into the calculation of the rate cap; after all, the profitability of brokered deposits relative to market rate is one of the key factors driving the movement of brokered deposits. However, due to their volatility, progressive restrictions on brokered deposits should also be implemented to prevent banks' abuse of them as an alternative funding source: the maximum brokered deposits held should not exceed 25 percent of a bank's total asset or a certain ratio to tier 1 capital stock. As a result, the total value of brokered deposits held in smaller and less-capitalized banks is lower than in larger and well-capitalized banks.

Insured deposits are also essential for banks' stability since deposit insurance increase consumers' confidence in parking their money at banks. Our results suggest that banks in the Central region tend to have lower insured brokered deposit proportions. Thus, FDIC might consider lowering the insurance threshold in the Central region to improve institutions' funding stability. However, since the creditability of the U.S. government endorses deposit insurance, depositors are less incentivized to supervise bank insolvency risk. Therefore, stricter risk management and stress tests should be implemented while lowering insurance thresholds for bank deposits.

Depository institutions can also improve their liquidity services to make consumers more willing to park their money in the banking system. As interest rates rise, tradable financial assets in the market somehow ensure depositors' dual needs for liquidity and yield; consumers may prefer to lock up their money in the financial markets rather than in depository institutions for the same maturity and liquidity. In reality, the banking industry does not provide consumers with liquidity services commensurate with that provided by the market. (Kasasa, 2015) According to sector surveys, approximately 70 percent of customers have maintained their accounts with the same banks over time, even though a significant proportion are unsatisfied with the products or services provided by these banks. Some depository institutions even impose fees for terminating accounts and relocating cash. Although the stickiness of deposit withdrawal alleviates a bank's liquidity in the short run, these costs and inconvenience might prompt customers to switch banks or even completely invest their wealth in financial markets in the long run, making them less willing to park their money in the banking system.

The FDIC may also develop mobile software for bank risk disclosure. The software regularly compiles the results of comprehensive risk and service quality assessments for banks and sets up a search function that enables depositors to identify the banks with the best indicators near their neighborhoods. This will strengthen depositors' awareness of bank risk, which will serve as an external regulatory pressure on banks to improve their service quality and liquidity risk control. According to 2022-2026 Strategic Plans, FDIC will expand its information technology investment to maintain the banking system's cybersecurity. It is not a bad idea to invest more resources in software development to optimize the service experience for depositors. By refining and upgrading banks' liquidity services combined with better deposit insurance services, they may expand their depositor base with more liquid and securitized deposit services they provide

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Table 1: Panel Regression Results 1

	Dependent variable:				
	Total	Domestic	Foreign	Demand	Money Market
	(1)	(2)	(3)	(4)	(5)
Time (Quarterly)	0.0001*** (0.00002)	0.00000 (0.00000)	0.00001 (0.00003)	−0.00000 (0.00000)	0.00000 (0.00000)
FFR 0	−0.208*** (0 002)	−0.0002*** (0 0001)	0 011*** (0 003)	−0.008*** (0 0003)	−0.010*** (0 0003)
FFR_1	0.047*** (0.003)	−0.00003 (0.0001)	0.002 (0.005)	−0.0004 (0.0004)	0.002*** (0.0005)
FFR_2	0.046*** (0.003)	0.0001 (0.0001)	−0.006 (0.005)	0.004*** (0.0004)	0.005*** (0.0005)
FFR_3	0.078*** (0.003)	0.00004 (0.0001)	−0.001 (0.005)	0.005*** (0.0004)	0.005*** (0.0005)
FFR_4	−0.126*** (0.002)	−0.0001*** (0.00005)	0.005* (0.003)	−0.012*** (0.0002)	−0.012*** (0.0003)
FFR 0ˆ2	0 012*** (0 0002)	0 00000 (0 00000)	−0.001** (0 0003)	0 001*** (0 00002)	−0.0001*** (0 00003)
Bank Classes	YES	YES	YES	YES	YES
Specialization	YES	YES	YES	YES	YES
Region	YES	YES	YES	YES	YES
Stock	YES	YES	YES	YES	YES
Trust Power Granted	YES	YES	YES	YES	YES
Insured Branch > 1	YES	YES	YES	YES	YES
Intercept			0.189*** (0.015)		
Observations	1,006,135	1,006,135	16,528	947,851	946,930
R^2	0.280	0.034	0.072	0.051	0.103
Adjusted R^2	0.268	0.017	0.071	0.035	0.088
F Statistic	14,776.300*** (df = 26; 989566)	1,321.510*** (df = 26; 989566)	1,305.332***	1,915.788*** (df = 26; 932185)	4,120.201*** (df = 26; 931303)
Note:					* p<0.1; ** p<0.05; *** p<0.01

Table 2: Panel Regression Results 2

	Dependent variable:				
	Saving	Time	Saving and Time	Interest Bearing	Non Interest Bearing
	(1)	(2)	(3)	(4)	(5)
Time (Quarterly)	−0.00000* (0.00000)	0.00000 (0.00000)	−0.00000 (0.00000)	0.00000* (0.00000)	−0.00000* (0.00000)
FFR 0	0.001** (0 0003)	0 008*** (0 0004)	0 007*** (0 0003)	0 015*** (0 0002)	−0.015*** (0 0002)
FFR_1	−0.002*** (0.0005)	0.003*** (0.001)	−0.0003 (0.0004)	−0.003*** (0.0004)	0.003*** (0.0004)
FFR_2	0.003*** (0.0005)	−0.012*** (0.001)	−0.003*** (0.0004)	−0.005*** (0.0004)	0.005*** (0.0004)
FFR_3	0.006*** (0.0005)	−0.013*** (0.001)	−0.006*** (0.0004)	−0.008*** (0.0004)	0.008*** (0.0004)
FFR_4	−0.013*** (0.0002)	0.037*** (0.0003)	0.012*** (0.0002)	0.016*** (0.0002)	−0.016*** (0.0002)
FFR_0ˆ2	−0.001*** (0.00002)	0.001*** (0.00003)	−0.0005*** (0.00002)	−0.001*** (0.00002)	0.001*** (0.00002)
Bank Classes	YES	YES	YES	YES	YES
Specialization	YES	YES	YES	YES	YES
Region	YES	YES	YES	YES	YES
Stock	YES	YES	YES	YES	YES
Trust Power Granted	YES	YES	YES	YES	YES
Insured Branch > 1	YES	YES	YES	YES	YES
Observations	946,930	946,930	999,197	1,004,350	1,004,350
R^2	0.074	0.264	0.052	0.113	0.117
Adjusted R^2	0.058	0.251	0.036	0.098	0.102
F Statistic	2,843.226*** (df = 26; 931303)	12,826.400*** (df = 26; 931303)	2,053.627*** (df = 26; 982680)	4,850.767*** (df = 26; 987820)	5,016.537*** (df = 26; 987820)
Note:					* p<0.1; ** p<0.05; *** p<0.01

Table 3: Panel Regression Results 3

	Dependent variable:				
	Retail	Brokered	Estimated Insured	Fully Insured	List Services
	(1)	(2)	(3)	(4)	(5)
Time (Quarterly)	−0.00000 (0.00000)	−0.00001* (0.00000)	−0.00000 (0.00000)	−0.00001* (0.00000)	−0.00000 (0.00000)
FFR 0	−0.015*** (0 0003)	−0.004*** (0 0004)	−0.007*** (0 0003)	−0.004*** (0 0004)	0 001*** (0 0004)
FFR_1	−0.010*** (0.0005)	0.003*** (0.001)	−0.008*** (0.001)	0.003*** (0.001)	0.001** (0.001)
FFR_2	0.008*** (0.0005)	−0.0004 (0.001)	0.002*** (0.001)	−0.0005 (0.001)	0.001 (0.001)
FFR_3	0.006*** (0.0005)	0.002*** (0.001)	−0.018*** (0.001)	0.003*** (0.001)	0.001 (0.001)
FFR_4	−0.015*** (0.0003)	−0.003*** (0.0004)	0.016*** (0.0003)	−0.003*** (0.0004)	−0.002*** (0.0003)
FFR 0ˆ2	0 003*** (0 00003)	−0 00002 (0 00004)	0 003*** (0 00003)	−0 00004 (0 00004)	−0.001*** (0 0001)
Bank Classes	YES	YES	YES	YES	YES
Specialization	YES	YES	YES	YES	YES
Region	YES	YES	YES	YES	YES
Stock	YES	YES	YES	YES	YES
Trust	YES	YES	YES	YES	YES
Insured Branch > 1	YES	YES	YES	YES	YES
Observations	1,005,685	1,004,350	1,006,135	1,004,350	277,735
R^2	0.093	0.004	0.061	0.003	0.004
Adjusted R^2	0.078	−0.012	0.045	−0.013	−0.025
F Statistic	3,909.736*** (df = 26; 989116)	165.596*** (df = 26; 987820)	2,473.565*** (df = 26; 989566)	133.048*** (df = 26; 987820)	38.643*** (df = 26; 270079)

Note: * p<0.1; ** p<0.05; *** p<0.01

Table 4: Panel Regression Results (Changes in Interest Rates) 1

	Dependent variable:				
	Total	Domestic	Foreign	Demand	Money Market
	(1)	(2)	(3)	(4)	(5)
Time (Quarterly)	0.0001*** (0.00002)	0.00000 (0.00000)	0.00000 (0.00003)	0.00000* (0.00000)	0.00001** (0.00000)
FFR Change	−0.020*** (0 001)	−0 00001 (0 00003)	0 002 (0 002)	0 009*** (0 0002)	0 003*** (0 0002)
Bank Classes	YES	YES	YES	YES	YES
Specialization	YES	YES	YES	YES	YES
Region	YES	YES	YES	YES	YES
Stock	YES	YES	YES	YES	YES
Trust	YES	YES	YES	YES	YES
Insured Branch > 1	YES	YES	YES	YES	YES
Intercept			0.211*** (0.015)		
Observations	1,006,135	1,006,135	16,528	947,851	946,930
R^2	0.189	0.033	0.059	0.017	0.050
Adjusted R^2	0.176	0.017	0.058	0.001	0.034
F Statistic	10,996.570*** (df = 21; 989571)	1,622.297*** (df = 21; 989571)	1,059.865***	783.261*** (df = 21; 932190)	2,316.874*** (df = 21; 931308)

Note: * p<0.1; ** p<0.05; *** p<0.01

Table 5: Panel Regression Results (Changes in Interest Rates) 2

	Dependent variable:				
	Saving	Time	Saving and Time	Interest Bearing	Non Interest Bearing
	(1)	(2)	(3)	(4)	(5)
Time (Quarterly)	0.00000 (0.00000)	−0.00001** (0.00000)	−0.00000 (0.00000)	−0.00000 (0.00000)	0.00000 (0.00000)
FFR Change	0 012*** (0 0002)	−0.033*** (0 0003)	−0.009*** (0 0002)	−0.007*** (0 0002)	0 007*** (0 0002)
Bank Classes	YES	YES	YES	YES	YES
Specialization	YES	YES	YES	YES	YES
Region	YES	YES	YES	YES	YES
Stock	YES	YES	YES	YES	YES
Trust	YES	YES	YES	YES	YES
Insured Branch > 1	YES	YES	YES	YES	YES
Observations	946,930	946,930	999,197	1,004,350	1,004,350
R^2	0.023	0.075	0.019	0.045	0.046
Adjusted R^2	0.007	0.060	0.003	0.029	0.030
F Statistic	1,067.166*** (df = 21; 931308)	3,615.686*** (df = 21; 931308)	929.378*** (df = 21; 982685)	2,191.189*** (df = 21; 987825)	2,248.766*** (df = 21; 987825)
Note:					* p<0.1; ** p<0.05; *** p<0.01

Table 6: Panel Regression Results (Changes in Interest Rates) 3

	Dependent variable:				
	Retail	Brokered	Estimated Insured	Fully Insured	List Services
	(1)	(2)	(3)	(4)	(5)
Time (Quarterly)	0.00000 (0.00000)	−0.00001* (0.00000)	−0.00000 (0.00000)	−0.00001* (0.00000)	0.00000 (0.00000)
FFR Change	0 018*** (0 0002)	−0.002*** (0 0003)	0 009*** (0 0002)	−0.002*** (0 0003)	0 0002 (0 0002)
Bank Classes	YES	YES	YES	YES	YES
Specialization	YES	YES	YES	YES	YES
Region	YES	YES	YES	YES	YES
Stock	YES	YES	YES	YES	YES
Trust	YES	YES	YES	YES	YES
Insured Branch > 1	YES	YES	YES	YES	YES
Observations	1,005,685	1,004,350	1,006,135	1,004,350	277,735
R^2	0.021	0.003	0.045	0.003	0.003
Adjusted R^2	0.005	−0.013	0.029	−0.014	−0.025
F Statistic	1,008.527*** (df = 21; 989121)	155.014*** (df = 21; 987825)	2,231.302*** (df = 21; 989571)	128.440*** (df = 21; 987825)	42.274*** (df = 21; 270084)
Note:					* p<0.1; ** p<0.05; *** p<0.01

Table 7

Deposit Type	**Definition**
Total Deposits	The sum of all deposits including demand deposits, money market deposits, other savings deposits, time deposits and deposits in foreign offices.
Domestic Deposits	The sum of all domestic office deposits, including demand deposits, money market deposits, other savings deposits and time deposits.
Foreign Deposits	The sum of all foreign office deposits, including demand deposits, money market deposits, other savings deposits and time deposits.
Demand Deposits	Total demand deposits included in transaction accounts held in domestic offices.
Money Market Deposits	Total money market deposit accounts held in domestic offices.
Saving Deposits	Total savings deposits held in domestic offices, aside from money market deposit accounts.
Time Deposits	Total non-transaction time deposits held in domestic offices. Prior to 2004, this item is not available for TFR reporters with assets less than $300 million and risk-based capital ratios in excess of 12 percent.
Interest Bearing Deposits	The sum of interest-bearing time and savings deposits held in domestic offices. This item is not available for Thrift Financial Report filers having both assets less than $300 million and risk-based capital ratios if 12 percent or more.
Non-interest Bearing Deposits	The sum of total demand deposits and non-interest-bearing time and savings deposits held in domestic offices.

Retail Deposits	The core deposit definition was changed in March 2011.Core deposits held in domestic offices now includes:total domestic office deposits minus - (1) time deposits of more than $250,000 held in domestic offices (2) brokered deposits of $250,000 or less held in domestic offices.Prior to the March 2010, core deposits were calculated as follows: Total domestic office deposits minus-(1) time deposits of $100,000 or more held in domestic offices.
Brokered Deposits	Total brokered deposits held in domestic offices. Brokered deposits represent funds which the reporting bank obtains, directly or indirectly, by or through any deposit broker for deposit into one or more deposit accounts. Thus, brokered deposits include both those in which the entire beneficial interest in a given bank deposit account or instrument is held by a single depositor and those in which the deposit broker sells participation in a given bank deposit account or instrument to one or more investors.Fully Insured brokered deposits are brokered deposits that are issued in denominations of $100,000
Estimated Insured Deposits	The estimated amount of FDIC Insured deposits in domestic offices and in Insured branches of Puerto Rico and US territories and possessions. notes: (1) as of July 21, 2010, the standard maximum deposit insurance amount was permanently raised to $250,000. This calculation uses the self-reported estimate of uninsured deposits filed by institutions that are greater than $1 billion.
Fully Insured Brokered Deposits	Brokered deposits held in domestic offices issued in denominations of less than $100,000, or in denominations of $100,000 or more and participated out by the broker in shares of less than $100,000note: although standard FDIC insurance coverage was temporarily raised from $100,000 to $250,000 in October 2008, institutions are required to report this item based on the $100,000 coverage limit through December 2009.
Non-Brokered Deposits	Estimated amount of deposits obtained through the use of deposit listing services that are not brokered. Available as of March 2011

Table 8	
Variable name	**Definition**
INTEREST RATE	
FFR_0	Current interest rate
FFR_1	Interest rate one quarter ago
FFR_2	Interest rate two quarters ago
FFR_3	Interest rate three quarters ago
FFR_4	Interest rate four quarters ago
FFR_0^2	Quadratic current interest rate
BANK CLASSIFICATION TYPE	
Commercial	commercial bank, national (federal) charter and fed member, supervised by the office of the comptroller of the currency (occ)
Insured Foreign Charter	Insured U.S branch of a foreign chartered institution (IBA)
Supervised State	FDIC supervised state-chartered thrifts and OCC supervised federally chartered thrifts
Saving	savings banks, state charter, supervised by FDIC
Commercial Non-Fed	commercial bank, state charter, and fed nonmember, supervised by the FDIC or OCC
Commercial or Saving	commercial or savings bank, state charter and fed member, supervised by the federal reserve (FRB)
BANK SPECIALIZATION GROUP	
Agricultural	agricultural production loans plus real estate loans secured by farmland in excess of 25 percent of total loans and assets
Credit Card	credit card loans plus securitized receivables in excess of 50 percent of of total assets plus securitized receivables
Commercial Lending	commercial and industrial loans, plus real estate construction and development loans, plus loans secured by commercial and real estate properties in excess of 25 percent of total assets
Mortgage Lending	residential mortgage loans, plus mortgage-backed securities, in excess of 50 percent of total assets
International Lending	assets greater than $10 billion and more than 25 percent of total assets in foreign offices
Consumer Lending	residential mortgage loans, plus credit card loans, plus other loans to individuals, in excess of 50 percent of total assets
Other Lending	assets greater than $1 billion but do not meet any of the definitions above, they have significant lending activity with no identified asset concentrations

BANK REGION	
Northeast	Region including states ME, VT, NH, MA, CT, RI, NY, NJ, PA, MD, DE
Southwest	Region including states AZ, NM, TX, OK
Southeast	Region including states AR, LA, MS, AL, TN, GA, KY, FL, SC, NC, VA, WV
West	Region including states WA, OR, CA, NV, ID, MT, WY, UT, CO, AK
Central	Region including states ND, SD, NE, KS, IA, MO, MN, WI, IL, IN, MI, IN, OH
Other	Region including other US territories
OTHER CONTROLS	
Stock	an institution which sells stock to raise capital
Trust Power Granted	a flag used to indicate institutions trust power status
Insured Branch > 1	indicates if an institution has branches that can accept FDIC insured deposits in more than one state